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Spatial Analysis of Social Vulnerability in the Informal Urban Settlements of Porto Alegre – RS, Brazil

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Abstract

This study aims to understand the social vulnerability in Informal Urban Settlements (NUIs) in Porto Alegre, Rio Grande do Sul, Brazil. The concept of social vulnerability originates in Human Rights. It refers to individuals or groups who are juridically or politically weakened in the promotion, protection, or guarantee of their right to citizenship. The Social Vulnerability Index (SVI), developed by the Institute for Applied Economic Research (IPEA) in partnership with the United Nations Development Programme (PNUD), is an important and strategic analytical tool for urban and regional planning, especially for understanding urban socio-spatial inequalities (IPEA, 2015). This research relies on the SVI, which consists of sixteen assets derived from census data from the Brazilian Institute of Geography and Statistics (IBGE). The SVI result is the arithmetic mean of three indicators: urban infrastructure, human capital, and income and employment, which indicate the well-being conditions of populations in contemporary societies. Each of these dimensions carries equal weight in the final SVI calculation (JERONIMO et.al., 2022).

The challenge of obtaining information on informality and precarious housing in Brazil represents an obstacle to formulating diagnostics capable of adequately supporting the development of urbanization and land regularization programs and strategies (FEITOSA; GONÇALVES; CUNHA, 2022). In this context, Sluter states that Brazil lacks topographic mapping and, as a result, faces historical consequences in property delineation and registration. The country has never had a comprehensive, updated reference map at the necessary scales to implement a land registry that could support land policies (SLUTER et al., 2020).

In 2019, IPEA consolidated its methodology for identifying irregular urban territories and characterizing Informal Urban Settlements. One key methodological step was the collection and analysis of indices, indicators, and potentially relevant variables for identifying Informal Urban Settlements. By analysing the SVI for Brazilian municipalities and census data aggregated to Human Development Units (UDHs), along with the Adequate Housing Index (IMA), it was possible to ascertain that these factors are applicable and essential for characterizing and identifying Informal Urban Settlements in vulnerable areas of Brazil. In other words, social vulnerability—and its forms of representation—plays a significant role in the methodological framework IPEA uses to characterize and identify Informal Urban Settlements nationally. However, the SVI is spatially represented by census tracts. Aggregating this information removes the individuality and identity of the collected data, preserving confidentiality and reducing data volume. Nevertheless, even as the smallest unit of aggregated information, census tracts tend to generalize social vulnerability when related to Informal Urban Settlements. This occurs because the delimitation of census tracts follows operational principles that do not necessarily correspond to the urban form and are disconnected from the socioeconomic condition of the population.

The choropleth method aims to create quantitative thematic representations of areas, where the dimension of the phenomenon is the area and the measurement level is numerical, following the concepts of cartographic language theory (MACEACHREN, 1994). The visual representation should display quantities corresponding to different areas. However, using data aggregated by census tracts can create a misleading notion of homogeneous distribution within a specific location, leading to a thematic data generalization when attempting to identify the real situation of social vulnerability in Informal Urban Settlements. This is because the surroundings can strongly influence the SVI results.

Considering these challenges, this research seeks to answer the question: Does the delimitation of census tracts influence the characterization of the Social Vulnerability Index (SVI) for the population living in Informal Urban Settlements?

Therefore, this study aims to disaggregate census data from the Urban Infrastructure dimension of the SVI to better understand the conditions present in Informal Urban Settlements (NUIs) in the municipality of Porto Alegre. In this context, the study proposes using the dasymetric mapping method—a specific type of zonal interpolation based on

cartographic techniques that employs auxiliary land use and land cover data to disaggregate census variables. Figure 1 presents the flowchart for the application of this methodology.

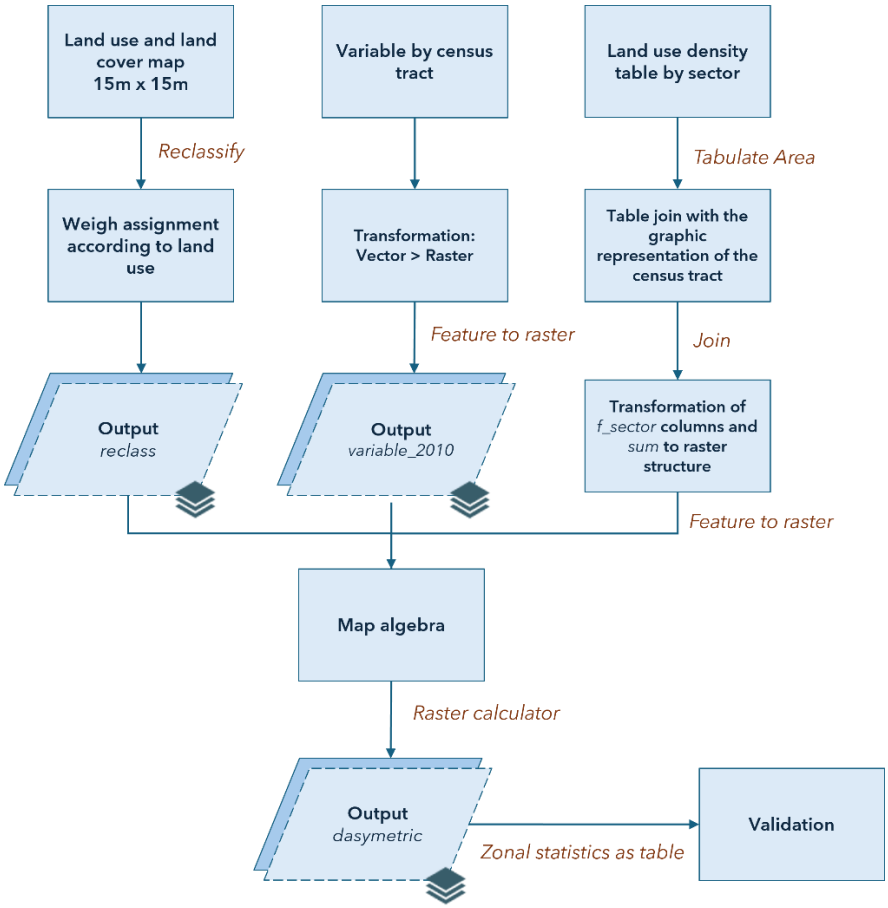

Figure 1. Flowchart for the application of dasymetric method.

The results include cartographic products, analyses of disaggregated variables related to the NUIs in the municipality, and the statistical validation of the applied dasymetric mapping. Throughout this research, it became evident that dasymetric mapping plays a fundamental role in the disaggregation of census data and enables detailed analyses of the phenomenon under study. The proposed method, when combined with census data, overcomes the limitations of traditional choropleth maps, which tend to homogenize, simplify, or obscure relevant information, while also enabling more accurate interpretations of the urban reality.

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